CLAIMS

WE CLAIM:

1. A multilayer pinned reference layer for a magnetic device, comprising:

at least one layer of magnetic material with varying composition coupled to at least one anti-ferromagnetic material (AFM) layer, wherein the magnetic layer self-seeds and provides the appropriate crystal texture within the reference layer.

2. The multilayer pinned reference layer of claim 1, wherein when given an appropriate anneal the AFM layer provides an exchange field greater than the coercivity of the reference layer.

3. A multilayer pinned reference layer for a magnetic device comprising:

at least one first layer of magnetic material;

at least one second layer of magnetic material in physical contact with the first layer forming a combined magnetic layer; and

at least one AFM layer coupled to the combined magnetic layer;

wherein the at least one first layer and the at least one second layer interact to self-seed and provide <111> crystal texture within the reference layer.

4. The multilayer pinned reference layer of claim 3, wherein when given an appropriate anneal the AFM layer provides an exchange field greater than the coercivity the reference layer.

5. The multilayer pinned reference layer of claim 3, wherein the magnetic device is a top pinned spin valve device.

6. The multilayer pinned reference layer of claim 3, further including an anti-ferromagnetic material layer in contact with the second layer.

7. The multilayer pinned reference layer of claim 3, wherein the first layer is CoFe and the second layer is NiFe.

8. The multilayer pinned reference layer of claim 7, wherein the first layer has a uniform thickness of between about 0 to 5 nanometers.

9. The multilayer pinned reference layer of claim 7, wherein the second layer has a uniform thickness of between about 0 to 4 nanometers.

10. The multilayer pinned reference layer of claim 3, wherein the first and second layers magnetically act as one and are predisposed to form an exchange bias with a provided anti-ferromagnetic material in the presence of an appropriate annealing process and a magnetic field.

11. The multilayer pinned reference layer of claim 10, wherein the first and second layers hold a pinned magnetic field.

12. The multilayer pinned reference layer of claim 11, wherein the pinned magnetic field of the multilayer pinned reference layer is between about 50 and 400 Oe.

13. The multilayer pinned reference layer of claim 11, wherein the pinned magnetic field is substantially localized within the multilayer pinned reference layer.

14. A multilayer pinned reference layer for a magnetic storage device, comprising:

at least one first layer of CoFe with a uniform thickness of between about 0 to 5 nanometers;

at least one second layer of NiFe with a uniform thickness of between about 0 to 4 nanometers, the second layer magnetically coupled to the first layer forming a combined magnetic layer; and

at least one AFM layer coupled to the combined magnetic layer;

wherein the layer of CoFe and the layer of NiFe interact to self-seed and provide <111> crystal texture within the reference layer.

15. The multilayer pinned reference layer of claim 14, wherein when given an appropriate anneal the AFM layer provides an exchange field greater than the coercivity the reference layer.

16. The multilayer pinned reference layer of claim 14, wherein the first and second layers are in direct physical contact.

17. The multilayer pinned reference layer of claim 16, further including an anti-ferromagnetic material layer in contact with the second layer.

18. The multilayer pinned reference layer of claim 16, wherein the first and second layers magnetically act as one and are predisposed to form an exchange bias with a provided anti-ferromagnetic material in the presence of an appropriate annealing process and a magnetic field.

19. The multilayer pinned reference layer of claim 16, wherein the pinned magnetic field of the multilayer pinned reference layer is between about 50 and 400 Oe.

20. The multilayer pinned reference layer of claim 16, wherein the pinning magnetic field is substantially localized within the multilayer pinned reference layer.

21. A magnetic memory device comprising:

at least one ferromagnetic data layer characterized by an alterable orientation of magnetization;

an intermediate layer in contact with the data layer;

a multilayer pinned ferromagnetic reference layer in contact with the intermediate layer, opposite the data layer, the reference layer characterized by;

at least one first layer of magnetic material; and

at least one second layer of magnetic material in physical contact with the first layer, the second layer magnetically coupled to the first layer forming a combined magnetic layer; and

at least one AFM layer coupled to the combined magnetic layer;

wherein the at least one first layer and the at least one second layer interact to self-seed and provide <111> crystal texture within the reference layer; and

wherein the first and second layers hold a pinned magnetic field.

22. The magnetic memory device of claim 21, wherein the pinned magnetic field of the pinned reference layer does not substantially overlap the data layer.

23. The magnetic memory device of claim 21, wherein the multilayer pinned ferromagnetic reference layer is above the data layer, establishing a top-pinned spin device.

24. The magnetic memory device of claim 21, wherein the multilayer pinned ferromagnetic reference layer is below the data layer, establishing a bottom-pinned spin device.

25. The magnetic memory device of claim 21, wherein the pinning magnetic field is substantially localized within the multilayer pinned reference layer.

26. The magnetic memory device of claim 21, wherein the pinned magnetic field of the multilayer pinned reference layer is between about 50 and 400 Oe.

27. The magnetic memory device of claim 21, wherein the first layer is CoFe and the second layer is NiFe.

28. The magnetic memory device of claim 27, wherein the first and second layers magnetically act as one and are predisposed to form an exchange bias with a provided anti-ferromagnetic material in the presence of an appropriate annealing process and a magnetic field.

29. The magnetic memory device of claim 27, wherein the first layer has a uniform thickness of between about 0 to 5 nanometers.

30. The magnetic memory device of claim 27, wherein the second layer has a uniform thickness of between about 0 to 4 nanometers.

31. A magnetic sensor device comprising:

at least one ferromagnetic sense layer characterized by an orientation of magnetization alterable in response to a magnetic field;

an intermediate layer in contact with the sense layer;

a multilayer pinned ferromagnetic reference layer in contact with the intermediate layer, opposite the sense layer, the reference layer characterized by;

at least one first layer of magnetic material; and

at least one second layer of magnetic material in physical contact with the first layer, the second layer magnetically coupled to the first layer forming a combined magnetic layer; and

at least one AFM layer coupled to the combined magnetic layer;

wherein the at least one first layer and the at least one second layer interact to self-seed and provide <111> crystal texture within the reference layer; and

wherein the first and second layers hold a pinned magnetic field.

32. The magnetic memory device of claim 31, wherein the first layer is CoFe and the second layer is NiFe.

33. The magnetic memory device of claim 32, wherein the first and second layers magnetically act as one and are predisposed to form an exchange bias with a provided anti-ferromagnetic material in the presence of an appropriate annealing process and a magnetic field.

34. A computer system comprising:

a main board;

at least one central processing unit (CPU) coupled to the main board; and

at least one memory store joined to the CPU by the main board, the memory store having a plurality of memory cells, each memory cell including:

at least one ferromagnetic data layer characterized by an alterable orientation of magnetization;

an intermediate layer in contact with the data layer;

a multilayer pinned ferromagnetic reference layer in contact with the intermediate layer, opposite the data layer, the reference layer characterized by;

at least one first layer of magnetic material; and

at least one second layer of magnetic material in physical contact with the first layer, the second layer magnetically coupled to the first layer forming a combined magnetic layer; and

at least one AFM layer coupled to the combined magnetic layer;

wherein the at least one first layer and the at least one second layer interact to self-seed and provide <111> crystal texture within the reference layer; and

wherein the first and second layers hold a pinned magnetic field.

35. The magnetic memory device of claim 26, wherein the pinned magnetic field of the pinned reference layer does not substantially overlap the data layer.

36. The magnetic memory device of claim 26, wherein the first layer is CoFe and the second layer is NiFe.

37. The magnetic memory device of claim 36, wherein the first and second layers magnetically act as one and are predisposed to form an exchange bias with a provided anti-ferromagnetic material in the presence of an appropriate annealing process and a magnetic field.

38. The magnetic memory device of claim 36, wherein the first layer has a uniform thickness of between about 0 to 5 nanometers.

39. The magnetic memory device of claim 36, wherein the second layer has a uniform thickness of between about 0 to 4 nanometers.